

## CLAIMS

1 1. A method of reading information characterized by comprising \  
2 steps of:  
3 one-dimensional arrangement;

4 extracting information concerning an elemental unit  
5 length of the information length of the binary digit information  
6 from the acquired signal; and

7 reading a ratio of the binary digit information to the  
8 information length based on the extracted elemental unit length  
9 information.

1 2. A method of reading information according to Claim 1,  
2 characterized in that the elemental unit length information is  
3 extracted as an elemental frequency information corresponding  
4 to the elemental unit length, a band limiting processing is  
5 effected on the acquired signal based on the extracted elemental  
6 frequency information, and thereafter the ratio of the  
7 information length of the binary digit information is read.

1 3. An information reading apparatus characterized by  
2 comprising:

3 a signal acquiring unit for acquiring from a medium, a  
4 signal containing binary digit information having a  
5 predetermined information length and an arrangement;

6 an elemental frequency extracting unit for extracting an  
7 elemental frequency corresponding to an elemental unit length  
8 of the binary digit information of the information length from

9 the acquired signal;  
10 a band limiting unit for limiting a frequency band of the  
11 acquired signal based on the extracted elemental frequency  
12 information;  
13 a timing point extracting unit for extracting a timing  
14 point which is in synchronism with the acquired signal and has  
15 the elemental frequency, based on the acquired signal and the  
16 elemental frequency information;  
17 an amplitude extracting unit for extracting an amplitude  
18 value of a signal from the band limiting unit in accordance with  
19 the timing point extracted by the timing point extracting unit;  
20 a tri-state value generating unit for generating tri-state  
21 value data from the amplitude values extracted by the amplitude  
22 extracting unit in accordance with the timing point; and  
23 a reading unit for reading a ratio of the binary digit  
24 information to the information length by calculating the  
25 tri-state value data generated by the tri-state value generating  
26 unit.

1 4. An information reading apparatus according to Claim 3,  
2 characterized in that the signal acquiring unit comprises a  
3 photoelectric converting unit for receiving a ray of incident  
4 light and converting the received ray of light into an electric  
5 signal based on the photoelectric conversion, a determining unit  
6 for determining whether the electric signal supplied from the  
7 photo-electric converting unit derives from photo-electric  
8 conversion effected on the ray of light reflected on the medium

9 or not, and a gate unit arranged to respond to the result of  
10 determination of the determining unit in such a manner that if  
11 it is determined that the signal component derives from  
12 photoelectric conversion effected on the reflected ray of light  
13 then the signal component is acquired as the acquired signal  
14 while if it is determined that the signal component derives from  
15 photoelectric conversion effected on any ray of light other than  
16 the reflected ray of light then the signal component is excluded  
17 from an object of a signal to be acquired.

1 5. An information reading apparatus according to Claim 4,  
2 characterized by an arrangement such that the determining unit  
3 is supplied with a signal deriving from conversion from an analog  
4 signal status to a digital signal status effected on the electric  
5 signal from the photoelectric converting unit, and the  
6 determining unit determines whether the signal derives from  
7 photoelectric conversion effected on the ray of light reflected  
8 on the medium or not.

1 6. An information reading apparatus for reading information  
2 from a medium having a mark representing a data group composed  
3 of a predetermined number of pairs of information elements, each  
4 of the information elements being composed of a white region  
5 and a black region disposed alternately with a certain width  
6 arranged to have an association with coded data, the information  
7 reading apparatus acquiring the data group information as an  
8 integer number ratio between the data widths of each information

9 element pair, the information reading apparatus comprising:  
10 a signal acquiring unit for detecting an analog signal  
11 having a variation corresponding to an intensity variation of  
12 a reflected ray of light which is caused by scanning the mark  
13 on the medium with a ray of light running at a predetermined  
14 velocity in the scanning direction, and effecting a sampling  
15 operation on the continuous signal at a predetermined sampling  
16 frequency to acquire the data group information represented by  
17 the mark recorded on the medium in a form of digital signal;  
18 an elemental frequency extracting unit for extracting an  
19 elemental frequency corresponding to an elemental unit length  
20 of the width of the white region and the black region from the  
21 acquired signal in the form of digital signal;  
22 a band limiting unit for limiting a frequency band of the  
23 acquired signal based on the extracted elemental frequency  
24 information;  
25 a timing point extracting unit for extracting a timing  
26 point which is in synchronism with the acquired signal and has  
27 the elemental frequency, based on the acquired signal and the  
28 elemental frequency information;  
29 an amplitude extracting unit for extracting an amplitude  
30 value of a signal from the band limiting unit in accordance with  
31 the timing point extracted by the timing point extracting unit;  
32 a tri-state value generating unit for generating tri-state  
33 value data from the amplitude values extracted by the amplitude  
34 extracting unit in accordance with the timing point; and  
35 a reading unit for reading a ratio of the binary digit

36 information to the information length by calculating the  
37 tri-state value data generated by the tri-state value generating  
38 unit, wherein

39 relationship among a width,  $\bar{b}$  [ $\mu\text{m}$ ] of the white region  
40 or the black region representing the elemental unit length of  
41 the binary digit information, the scanning velocity,  $v_{\text{max}}$  [m/s]  
42 of the scanning ray of light, and the sampling frequency,  $f_s$  [MHz]  
43 can be expressed by the following equation

44 
$$2 < f_s / (2 \cdot \bar{b} / v_{\text{max}}) \leq 1$$

1 7. A method of acquiring a signal for use with an information reading apparatus having a signal acquiring unit for acquiring a signal containing binary digit information recorded on a medium so as to have a predetermined information length, the information reading apparatus being arranged to extract information regarding an elemental unit length of the information length of the binary digit information from the acquired signal, thereby to read a ratio of the binary digit information to the information length based on the extracted elemental unit length information, the method of acquiring a signal for use with the information reading apparatus characterized in that

12 the signal acquiring unit acquires a signal containing  
13 the signal component and also a component other than one deriving  
14 from the medium having the binary digit information recorded  
15 thereon, determination is made on the acquired signal so as to  
16 identify a signal portion deriving from the medium having the  
17 binary digit information recorded thereon by using an amplitude

18 averaging calculation processing, and  
19 the signal component deriving from the medium is cut out  
20 in accordance with the result of determination, and the cut-out  
21 portion is acquired as a signal containing the binary digit  
22 information.

1 8. A method of effecting a band limiting processing for use 5  
2 with an information reading apparatus having a signal acquiring  
3 unit for acquiring a signal containing binary digit information  
4 recorded on a medium so as to have a predetermined information  
5 length, the information reading apparatus being arranged to  
6 extract information regarding an elemental unit length of the  
7 information length of the binary digit information from the  
8 acquired signal, thereby to read a ratio of the binary digit  
9 information to the information length based on the extracted  
10 elemental unit length information, the method of effecting a  
11 band limiting processing for use with the information reading  
12 apparatus characterized in that  
13 as a preprocessing for reading the ratio data of the binary  
14 digit information to the information length, an elemental  
15 frequency corresponding to the elemental unit length is extracted  
16 from the acquired signal, and the frequency band of the acquired  
17 signal is limited based on the extracted elemental frequency.

1 9. A method of extracting a timing point amplitude for use with 6  
2 an information reading apparatus having a signal acquiring unit  
3 for acquiring a signal containing binary digit information

4 recorded on a medium so as to have a predetermined information  
5 length, an elementary frequency extracting unit for extracting  
6 an elementary frequency corresponding to an elementary unit  
7 length of the information length of the binary digit information  
8 obtained from the acquired signal, and a band limiting unit for  
9 limiting a frequency band of the acquired signal based on the  
10 extracted elemental frequency information, wherein a ratio of  
11 the binary digit information to the information length is read  
12 from the signal having undergone the frequency band limitation  
13 in the band limiting unit, the method of extracting the timing  
14 point amplitude for use with the information reading apparatus  
15 characterized in that

16 as a preprocessing for reading the ratio data of the binary  
17 digit information to the information length, a timing point in  
18 synchronism with the acquired signal and having the elemental  
19 frequency is extracted based on the acquired signal and the  
20 elemental frequency information, an amplitude value of a signal  
21 from the band limiting unit is extracted in accordance with the  
22 extracted timing point, and tri-state value data is generated  
23 from the extracted amplitude values in accordance with the timing  
24 point.

1 10. A method of reading information from a medium having a mark 7  
2 recorded thereon, the mark representing a data group composed  
3 of a predetermined number of information element pairs each  
4 composed of a white region and a black region each having a width  
5 length and disposed alternately on the mark for representing

6 the data group, the method of reading information achieving  
7 information reading by acquiring the data group information as  
8 an integer number ratio between the width length data of each  
9 information element pair, characterized by comprising steps of:

10 scanning a ray of light on the mark at a predetermined  
11 velocity to cause a reflected ray of light, detecting a signal  
12 having a variation corresponding to an intensity variation of  
13 the reflected ray of light deriving from the scanning in the  
14 scanning direction, thereby acquiring a signal containing binary  
15 digit information corresponding to the intensity variation of  
16 the reflected ray of light;

17 extracting an elemental frequency corresponding to an  
18 elemental width time of the width data from the acquired signal;

19 effecting band limitation on the acquired signal to obtain  
20 an optimum signal band based on the extracted elemental  
21 frequency; and

22 reading integer number ratio between the data widths of  
23 each information element pair from the acquired signal having  
24 undergone the band limitation based on the elemental frequency.

1 11. A method of reading information according to Claim 10,  
2 characterized in that each processing from a step of acquiring  
3 the detected signal having the intensity variation in the  
4 reflected ray of light to a step of reading the integer number  
5 ratio between the width length data of each information element  
6 pair contains a differential processing characteristic of a time  
7 span substantially corresponding to the elemental width time



8 or a time span substantially corresponding to one slightly  
9 smaller than the elemental width time.

1 12. A method of reading information according to Claim 10,  
2 characterized in that each processing from a step of acquiring  
3 the detected signal having the intensity variation in the  
4 reflected ray of light to a step of reading the integer number  
5 ratio between the width length data of each information element  
6 pair contains a differentiating processing characteristic of  
7 a gain peak frequency substantially corresponding to the  
8 elemental frequency equivalent to the elemental width time or  
9 a frequency substantially corresponding to one slightly larger  
10 than the elemental frequency.

1 13. A method of reading information according to Claim 12,  
2 characterized in that the differentiating processing  
3 characteristic is arranged to have a gain characteristic of a  
4 cosine equivalent characteristic having a gain peak frequency  
5 substantially corresponding to the elemental width time of the  
6 width information of the input signal or a gain peak frequency  
7 substantially corresponding to one slightly larger than the gain  
8 peak frequency whereas the differentiating processing  
9 characteristic is arranged to have a phase characteristic tending  
10 to vary lineally with respect to the frequency.

1 14. A method of reading information according to Claim 10,  
2 characterized in that the step of extracting the elemental

3 frequency is further arranged to comprise steps of:  
4       effecting a differentiating processing on the acquiring  
5 signal in such a manner that the gain peak frequency is set to  
6 a value equal to or larger than the maximum frequency of the  
7 acquired signal in a signal acquisition allowable region;  
8       effecting a squaring processing on a signal having  
9 undergone the differentiating processing;  
10       analyzing the result deriving from the squaring processing  
11 based on frequency spectrums; and  
12       determining that a significant certain frequency except  
13 for 0Hz is regarded as the elemental frequency based on the result  
14 of analysis using the frequency spectrums.

1 15. A method of reading information according to Claim 10,  
2 characterized in that the step of extracting the elemental  
3 frequency is further arranged to comprise steps of:  
4       effecting a differentiating processing on the acquiring  
5 signal in such a manner that the gain peak frequency is set to  
6 a value equal to or larger than the maximum frequency of the  
7 acquired signal in a signal acquisition allowable region;  
8       effecting a squaring processing on a signal having  
9 undergone the differentiating processing;  
10       analyzing the result deriving from the squaring processing  
11 based on frequency spectrums;  
12       determining that a significant certain frequency except  
13 for 0Hz is regarded as the elemental frequency based on the result  
14 of analysis using the frequency spectrums;

15           effecting demodulating processing on the signal having  
16 undergone the squaring processing based on the frequency obtained  
17 by the frequency calculation and forming the signal into a vector;  
18           removing a high frequency component from the signal having  
19 undergone the demodulation and the vector formation;  
20           obtaining a phase difference between a signal from which  
21 the high frequency component is removed and a signal delayed  
22 by one sample time from that signal;  
23           calculating a deviation of the elemental frequency in terms  
24 of frequency relative to the obtained elemental frequency based  
25 on the above-obtained phase difference; and  
26           determining that the result obtained by adding the  
27 calculated frequency deviation to the obtained elemental  
28 frequency is the elemental frequency information.

1   16. A method of reading information according to Claim 10,  
2 characterized in that when the signal containing the binary digit  
3 information is acquired, the manner of signal acquisition is  
4 such that the signal is acquired as a digital signal having  
5 undergone sampling operation at a predetermined sampling  
6 interval, and as a preprocessing for reading the integer number  
7 ratio between the width length data of each information element  
8 pair, data number decimation is effected on the digital signal  
9 having undergone the signal band limitation in accordance with  
10 the elemental frequency information.

1   17. A method of reading information from a medium having a mark

2 recorded thereon, the mark representing a data group composed  
3 of a predetermined number of information element pairs each  
4 composed of a white region and a black region each having a width  
5 length and disposed alternately on the mark for representing  
6 the data group, the method of reading information achieving  
7 information reading by acquiring the data group information as  
8 an integer number ratio between the width length data of each  
9 information element pair, the method characterized by comprising  
10 steps of:

11 scanning a ray of light on the mark at a predetermined  
12 velocity to cause a reflected ray of light, detecting a signal  
13 having a variation corresponding to an intensity variation of  
14 the reflected ray of light deriving from the scanning in the  
15 scanning direction, thereby acquiring a signal containing binary  
16 digit information corresponding to the intensity variation of  
17 the reflected ray of light;

18 extracting a timing point containing the width data from  
19 the acquired signal; and

20 reading the integer number ratio between the data widths  
21 of each information element pair from the mark in accordance  
22 with the extracted timing point.

1 18. A method of reading information according to Claim 17,  
2 characterized in that when the timing point is extracted,  
3 differentiating processing is effected on the acquired signal,  
4 a timing point is specified in the signal having undergone the  
5 differentiating processing in order that the information length

6 of the binary digit information recorded on the medium can be  
7 read, and tri-state value digital information is extracted from  
8 the amplitude of the signal having undergone the differentiating  
9 processing at every specified timing point.

1 19. A method of reading information according to Claim 17,  
2 characterized in that when the timing point is extracted,  
3 differentiation processing is effected on the acquired signal,  
4 a frequency component corresponding to the elemental width time  
5 of the width length data is extracted while the signal having  
6 undergone the differentiation processing is handled as an input  
7 signal, a periodic signal is generated so as to correspond to  
8 the elemental width time while the signal having undergone the  
9 differentiating processing is handled as an input signal, and  
10 a timing point corresponding to the existing point of the mark  
11 width information is specified while the generated periodic  
12 signal is handled as an input signal, whereas

13 when the integer number ratio between the width length  
14 data of each information element pair is read, an amplitude value  
15 is taken out from the signal having undergone the differentiation  
16 processing at every specified timing point, and the amplitude  
17 value of the signal taken out at every specified timing point  
18 is converted into tri-state value digital data.

1 20. A method of reading information from a medium having a mark a  
2 recorded thereon, the mark representing a data group composed  
3 of a predetermined number of information element pairs each

4 composed of a white region and a black region each having a width  
5 length and disposed alternately on the mark for representing  
6 the data group, the method of reading information achieving  
7 information reading by acquiring the data group information as  
8 an integer number ratio between the width length data of each  
9 information element pair, the method characterized by comprising  
10 steps of:

11 scanning the mark with a ray of light running at a  
12 predetermined velocity;

13 receiving a ray of light coming from the outside and  
14 outputting an intensity variation detecting signal representing  
15 the intensity variation of the received ray of light; and

16 determining whether or not the received ray of light is  
17 one having scanned the mark and reflected therefrom based on  
18 the intensity variation detecting signal; wherein

19 in accordance with the result of determination, a signal  
20 reflected on the mark coming from an intensity variation  
21 detecting width information medium is acquired as a signal for  
22 reading information of the data group as an integer number ratio  
23 between the width length data of each information element pair,  
24 while any component of the intensity variation state detecting  
25 signal other than the component of the ray of light reflected  
26 on the mark is excluded from an object of the signal to be acquired.

1 21. A method of reading information according to Claim 20,  
2 characterized in that when examination is made to determine  
3 whether the received ray of light is one having scanned the mark

4 and reflected therefrom or not, the intensity variation optical  
5 signal is subjected to a differentiation processing, the  
6 differentiated signal having undergone the differentiating  
7 processing is squared, and moving average is calculated on the  
8 squared differentiated signal, and

9 an intensity variation state detecting signal part is cut  
10 out from the ray of light reflected on the mark based on a value  
11 obtained by the method of moving average, whereby the cut-out  
12 signal part is acquired as a acquired signal.

1 22. A method of reading information according to Claim 20,  
2 characterized by a procedure to be done when examination is made  
3 to determine whether the received ray of light is one having  
4 scanned the mark and reflected therefrom or not, the procedure  
5 comprising steps of:

6 subjecting the intensity variation optical signal to a  
7 differentiation processing;

8 squaring the differentiated signal;

9 calculating moving average on the squared differentiated  
10 signal;

11 examining whether the extracted maximum value of the moving  
12 averages exceeds a first threshold value or not to determine  
13 a status of validity for the squared differentiated signal in  
14 such a manner that, if it is determined that the maximum value  
15 exceeds the first threshold value the differentiated squared  
16 signal is regarded as a valid signal while if is determined that  
17 the maximum value does not exceed the first threshold value the

18 differentiated squared signal is regarded as an invalid signal;  
19 effecting an averaging processing on the differentiated  
20 squared signal in a period in which the differentiated squared  
21 signal is valid, thereby obtaining an averaged value thereof;  
22 extracting the maximum value from the differentiated  
23 squared signal in a period in which the differentiated squared  
24 signal is valid;  
25 calculating the difference between the averaged value and  
26 the maximum value of the differentiated squared signal in a period  
27 in which the differentiated squared signal is valid;  
28 comparing the difference with a predetermined second  
29 threshold value to determine a way of acquiring the intensity  
30 variation state detecting signal in such a manner that, if the  
31 difference is smaller than the second threshold value a portion  
32 of the intensity variation state detecting signal corresponding  
33 to the aforesaid period is cut out so that only the cut-out signal  
34 portion is acquired as an acquired signal while if the difference  
35 is larger than the second threshold value the portion of the  
36 intensity variation state detecting signal corresponding to the  
37 aforesaid period is excluded as an object to be acquired as the  
38 acquired signal.

1 23. A method of reading information characterized by comprising \ ,  
2 a step of acquiring a value from a signal containing binary digit  
3 information having a predetermined information length and  
4 deriving from information elements arrayed one-dimensionally  
5 on a medium at every equal time interval, wherein



6           when an elemental unit length of the information length  
7 of the binary digit information is extracted from the acquired  
8 signal, the portion of the signal for extracting the state of  
9 the binary digit information from the medium information has  
10 a band narrower than that of the characteristic for  
11 differentiation based on the equal time interval.

1   24. A method of reading information according to Claim 23,  
2 characterized in that the elemental unit length information is  
3 extracted as elemental frequency information corresponding to  
4 the elemental unit length, the read signal is subjected to  
5 band-limitation processing based on the extracted elemental  
6 frequency information, and after differentiating processing is  
7 effected thereon, a ratio of binary digit information to the  
8 information length is read.

1   25. A read signal processing unit comprising: W  
2           means for acquiring a signal containing binary digit  
3 information having a predetermined information length and  
4 deriving from information elements arrayed one-dimensionally  
5 on a medium and extracting an elemental frequency corresponding  
6 to the elemental unit length of the information length of the  
7 binary digit information from the acquired signal; and  
8           means for effecting a band limiting processing on the  
9 acquired signal based on the extracted elemental frequency signal  
10 and thereafter extracting boundary information of the binary  
11 digit information.

1 26. A read signal processing unit comprising: 12  
2 means for acquiring a signal containing binary digit  
3 information having a predetermined information length and  
4 deriving from information elements arrayed one-dimensionally  
5 on a medium and extracting an elemental frequency corresponding  
6 to the elemental unit length of the information length of the  
7 binary digit information from the acquired signal; and  
8 means for effecting a band limiting processing on the  
9 acquired signal based on the extracted elemental frequency signal  
10 and thereafter extracting a ratio of the information length of  
11 the binary digit information.

1 27. A method of processing a read signal comprising steps of 13  
2 acquiring a signal containing binary digit information having  
3 a predetermined information length and deriving from information  
4 elements arrayed one-dimensionally on a medium, extracting an  
5 elemental frequency information corresponding to the elemental  
6 unit length of the information length of the binary digit  
7 information from the acquired signal, effecting a band limiting  
8 processing on the acquired signal based on the extracted  
9 elemental frequency signal, and thereafter extracting a ratio  
10 of the information length of the binary digit information, the  
11 method of processing a read signal carrying out further procedure  
12 upon extracting the elemental frequency, the further procedure  
13 comprising steps of:  
14 effecting a differentiation processing on the signal

15 acquired from the medium in such a manner that the gain peak  
16 frequency is set to a value equal to or larger than the maximum  
17 frequency of the acquired signal in a signal acquisition  
18 allowable region;

19 effecting a squaring processing on a signal having  
20 undergone the differentiating processing;

21 analyzing the result deriving from the squaring processing  
22 based on frequency spectrums;

23 calculating a characteristic data having a property  
24 inverse to an approximated characteristic data on the result  
25 of the frequency spectrum analysis;

26 correcting the result of the frequency spectrum analysis  
27 by using the inverse characteristic data obtained by the  
28 calculation; and

29 extracting a significant certain frequency except for 0Hz  
30 as the elemental frequency based on the result of analysis using  
31 the frequency spectrums.

1 28. A method of processing a read signal for use with an 14  
2 information reading apparatus comprising a signal acquiring unit  
3 for acquiring a signal containing binary digit information having  
4 a predetermined information length and deriving from information  
5 elements arrayed one-dimensionally on a medium, and a read signal  
6 processing unit for extracting an elemental frequency  
7 information corresponding to the elemental unit length of the  
8 information length of the binary digit information from the  
9 acquired signal, effecting a band limiting processing on the

10 acquired signal based on the extracted elemental frequency signal,  
11 and thereafter reading a ratio of the information length of the  
12 binary digit information, the method of processing a read signal  
13 for use with the information reading apparatus carrying out  
14 further procedure upon extracting the elemental frequency by  
15 the read signal processing unit, the further procedure comprising  
16 steps of:

17       effecting a differentiation processing on the signal  
18 acquired by the signal acquiring unit in such a manner that the  
19 gain peak frequency is set to a value equal to or larger than  
20 the maximum frequency of the acquired signal in a signal  
21 acquisition allowable region;

22       effecting a squaring processing on a signal having  
23 undergone the differentiation processing;

24       analyzing the result deriving from the squaring processing  
25 based on frequency spectrums;

26       calculating a characteristic data having a property  
27 inverse to an approximated characteristic data on the result  
28 of the frequency spectrum analysis;

29       correcting the result of the frequency spectrum analysis  
30 by using the inverse characteristic data obtained by the  
31 calculation; and

32       extracting a significant certain frequency except for 0Hz  
33 as the elemental frequency based on the result of the frequency  
34 spectrums analysis corrected.

1   29. A read signal processing apparatus comprising an elemental

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2 frequency extracting unit for acquiring a signal containing  
3 binary digit information having a predetermined information  
4 length and deriving from information elements arrayed  
5 one-dimensionally on a medium and extracting elemental frequency  
6 information corresponding to the elemental unit length of the  
7 information length of the binary digit information from the  
8 acquired signal, and an information length ratio extracting unit  
9 for effecting a band limiting processing on the acquired signal  
10 based on the elemental frequency signal extracted by the  
11 elemental frequency extracting unit and thereafter extracting  
12 a ratio of the information length of the binary digit information,  
13 the elemental frequency extracting unit comprising:  
14 a differentiation processing unit for effecting a  
15 differentiation processing on the signal acquired from the medium  
16 in such a manner that the gain peak frequency is set to a value  
17 equal to or larger than the maximum frequency of the acquired  
18 signal in a signal acquisition allowable region;  
19 a squaring processing unit for effecting a squaring  
20 processing on a signal having undergone the differentiation  
21 processing in the differentiation processing unit;  
22 a frequency spectrum analyzing unit for analyzing the  
23 result deriving from the squaring processing effected by the  
24 squaring processing unit based on frequency spectrums;  
25 an inverse characteristic data calculating unit for  
26 calculating a characteristic data having a property inverse to  
27 an approximated characteristic data which results from the  
28 frequency spectrum analysis supplied from the frequency spectrum

29 analyzing unit;

30 an analyzed result correcting unit for correcting the  
31 result of the frequency spectrum analysis by using the inverse  
32 characteristic data obtained by the calculation by the inverse  
33 characteristic data calculating unit; and

34 an extracting unit for extracting a significant certain  
35 frequency except for 0Hz as the elemental frequency based on  
36 the result of the frequency spectrum analysis corrected by the  
37 analyzed result correcting unit.

1 30. An information reading apparatus composed of a signal  
2 acquiring unit for acquiring a signal containing binary digit  
3 information having a predetermined information length and  
4 deriving from information elements arrayed one-dimensionally  
5 on a medium and a reading processing unit comprising an elemental  
6 frequency extracting unit for extracting elemental frequency  
7 information corresponding to the elemental unit length of the  
8 information length of the binary digit information from the  
9 acquired signal supplied from the signal acquiring unit and an  
10 information length ratio extracting unit for effecting a band  
11 limiting processing on the acquired signal based on the elemental  
12 frequency signal extracted by the elemental frequency extracting  
13 unit and thereafter extracting a ratio of the information length  
14 of the binary digit information,

15 the elemental frequency extracting unit comprising:

16 a differentiation processing unit for effecting a  
17 differentiating processing on the signal acquired from the medium

18 in such a manner that the gain peak frequency is set to a value  
19 equal to or larger than the maximum frequency of the acquired  
20 signal in a signal acquisition allowable region;  
21 a squaring processing unit for effecting a squaring  
22 processing on a signal having undergone the differentiation  
23 processing in the differentiation processing unit;  
24 a frequency spectrum analyzing unit for analyzing the  
25 result deriving from the squaring processing effected by the  
26 squaring processing unit based on frequency spectrums;  
27 an inverse characteristic data calculating unit for  
28 calculating a characteristic data having a property inverse to  
29 an approximated characteristic data on the result of the  
30 frequency spectrum analysis supplied from the frequency spectrum  
31 analyzing unit;  
32 an analyzed result correcting unit for correcting the  
33 result of the frequency spectrum analysis by using the inverse  
34 characteristic data obtained by the calculation by the inverse  
35 characteristic data calculating unit; and  
36 an extracting unit for extracting a significant certain  
37 frequency except for 0Hz as the elemental frequency based on  
38 the result of the frequency spectrums analysis corrected by the  
39 analyzed result correcting unit.